REPORT

# NEW PUBLIC SCHOOL IN EPPING

EPPING, NSW

## WIND ENVIRONMENT DESKTOP ASSESSMENT

RWDI PROJECT #2190042
APRIL 23, 2021

**SUBMITTED TO**

**School Infrastructure NSW**
Level 8, 259 George Street
Sydney NSW 2000

**SUBMITTED BY**

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# 1. INTRODUCTION

RWDI Australia Pty Ltd. (RWDI) was engaged by School Infrastructure NSW to assess the pedestrian wind environment for the proposed New Public School in Epping, NSW (Image 1). This assessment has been prepared in response to the Planning Secretary's Environmental Assessment Requirement for an Environmental Impact Statement which considers the wind conditions on and around the site (SSD-8873789). Key Issue 5 (Environmental Amenity) notes the EIS is to: *"Assess amenity impacts on the surrounding locality due to the building envelopes, including solar access, visual privacy, visual amenity, overshadowing, <u>wind impacts</u> and acoustic impacts. <u>A high level of environmental amenity for any surrounding residential land uses must be demonstrated</u>".*

This qualitative wind assessment is based on the following:

- A review of regional long-term meteorological data;
- Design drawings received by RWDI on April 14, 2021;
- Wind-tunnel tests undertaken by RWDI in Australia and around the world;
- Our engineering judgement and knowledge of wind flows around buildings[1-3]; and
- Use of 3D software developed by RWDI (Windestimator[2]) for estimating the potential wind conditions around generalized building forms.

This approach provides a screening-level estimation of potential wind conditions on and around the development. Conceptual wind control measures to improve wind comfort are recommended, where necessary. In order to quantify these conditions or refine any conceptual mitigation measures, physical scale-model tests in a boundary-layer wind tunnel would typically be required.

Note that other wind issues, such as those related to cladding and structural wind loads, door operability, air quality, etc., are not considered in the scope of this assessment.

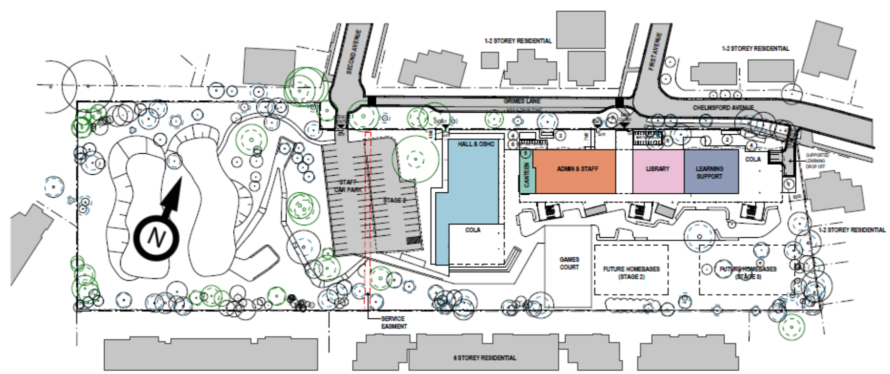


**Image 1: Site Plan**

1. H. Wu and F. Kriksic (2012). "Designing for Pedestrian Comfort in Response to Local Climate", *Journal of Wind Engineering and Industrial Aerodynamics*, vol.104-106, pp.397-407.
2. H. Wu, C.J. Williams, H.A. Baker and W.F. Waechter (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", *ASCE Structure Congress 2004,* Nashville, Tennessee.
3. C.J. Williams, H. Wu, W.F. Waechter and H.A. Baker (1999), "Experience with Remedial Solutions to Control Pedestrian Wind Problems", *10th International Conference on Wind Engineering*, Copenhagen, Denmark.

# 2. SITE INFORMATION AND BUILDING DESIGN

The proposed development is for the establishment of a new K-6 Public School, master planned to cater for up to 1,000 students (Images 2 through 4). It will involve:

- Demolition of existing structures associated with the former use of the site as a TAFE campus;
- Construction of new buildings on the eastern and central portions of the site. The works are proposed to be undertaken in stages. Facilities which will generally include:
  - Home bases (classrooms) suitable for a school population of 1,000 students;
  - Administration and staff areas:
  - Hall and canteen;
  - Library;
  - COLA;
  - Special education unit; and
  - Special programs area.
- Play spaces in various locations;
- Accessible paths linking the school facilities; and
- A staff car park accessed from Second Avenue.

The proposal will also require potential remediation of the land and tree/vegetation removal. The works are proposed to be undertaken in stages. The application will be lodged as a concept development application. The application will also seek approval for the Stage 1 works. The Stage 1 works will provide a total of 25 home bases and associated facilities together with a hall and canteen, administration facilities and play spaces. Car parking for the Stage 1 development will also be provided.

The site is located at 86 Chelmsford Avenue (Image 2). The subject site for the school is noted to slope downwards to the west (Mobbs Lane Reserve, covered by dense trees). It is adjacent to a cluster of mid-rise buildings to the immediate south and surrounded by typical dense low-rise suburban residential buildings in all other directions.


**Image 2: View of the Existing Site and Surroundings**
**(Photo Courtesy of GoogleTM Earth)**

# 2. SITE INFORMATION AND BUILDING DESIGN

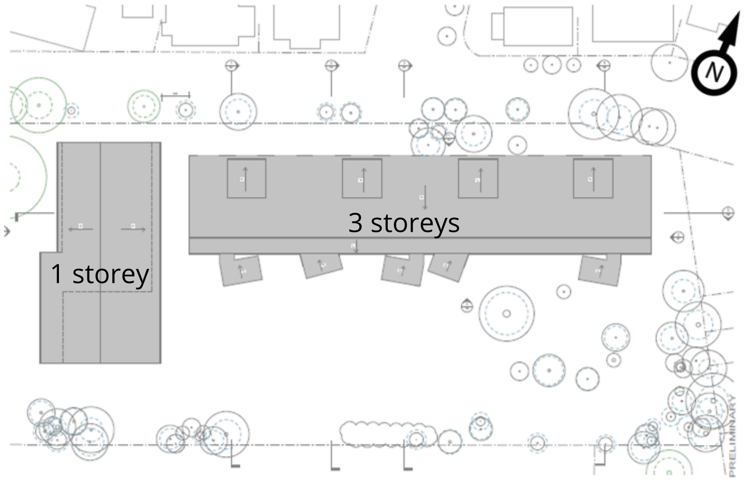



**Image 3: Roof Plan**


**Image 4: Northwest and Southeast Elevations**

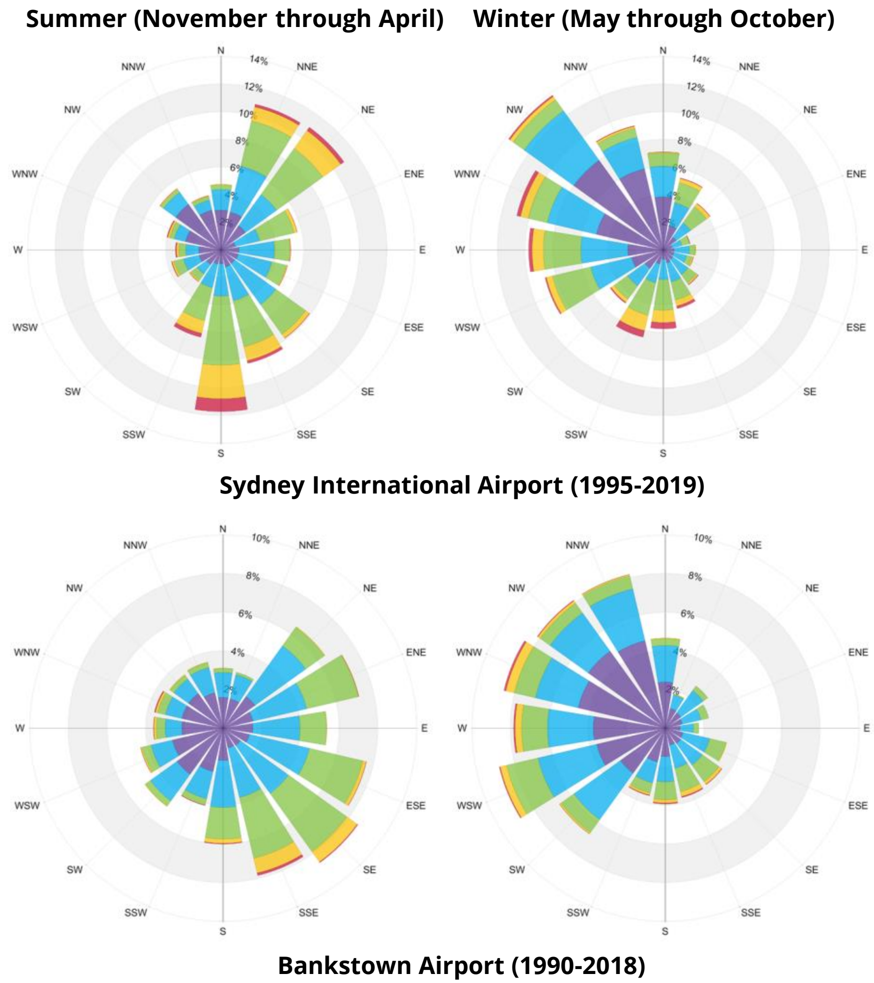
# 3. METEOROLOGICAL DATA

Sydney International Airport is located approximately 20km to the south-southeast of the project site and Bankstown Airport is 17 km to the south-southwest. Meteorological data recorded at these two airports were used as a reference for wind conditions in the study area.

The distributions of wind frequency and directionality for the summer (November through April) and winter (May through October) seasons are shown in Image 5. When all wind data are considered, winds are frequent from the northeast though south directions during the summer, and from the southwest through northwest directions in the winter.

Strong winds of a mean speed greater than 30 km/h, measured at the airports, occur more often in summer than in the winter. Wind speeds are higher at Sydney International Airport due to its close proximity to the ocean.

Winds from the northeast, southeast, south, west and northwest directions are considered to be prevalent for the current project; however, our analysis method has accounted for all wind directions.



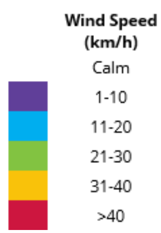




**Image 5: Directional Distribution of Winds Approaching Airports**

# 4. PEDESTRIAN WIND CRITERIA

Consideration for the wind comfort conditions for the development have been based on the RWDI pedestrian wind criteria. These criteria have been developed by RWDI through research and consulting practice since 1974. They have also been widely accepted by municipal authorities and by the building design and city planning community.

## 4.1 Pedestrian Safety

Pedestrian safety is associated with excessive gust wind speeds that can adversely affect a pedestrian's balance and footing. If strong winds that can affect a person's balance (**83 km/h**) occur more than 0.1% of the time or 9 hours per year, the wind conditions are considered severe.

## 4.2 Pedestrian Comfort

Wind comfort levels are categorized by typical pedestrian activities:

- **Sitting (≤ 10 km/h)**: Calm or light breezes desired for outdoor seating areas where one can read a paper without having it blown away.
- **Standing (≤ 14 km/h)**: Gentle breezes suitable for main building entrances and bus stops.
- **Strolling (≤ 17 km/h)**: Moderate winds that would be appropriate for window shopping and strolling along a downtown street, plaza or park.
- **Walking (≤ 20 km/h)**: Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering.
- **Uncomfortable**: None of the comfort categories are met.

Wind conditions are considered suitable for sitting, standing, strolling or walking if the associated wind speeds are expected for at least four out of five days (80% of the time). Wind control measures are typically required at locations where winds are rated as uncomfortable or they exceed the wind safety criterion.

These criteria for wind forces represent average wind tolerance. They are sometimes subjective and regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. can also affect people's perception of the wind climate.

For the current development, wind speeds comfortable for walking or strolling are appropriate for walkways, car parking and playground, and lower wind speeds, comfortable for standing, are required for building entrances and staircases, where students may linger. Wind speeds comfortable for sitting or standing are desired for the covered outdoor learning areas.

## 5.1 Background

Predicting wind speeds and occurrence frequencies is complicated. It involves building geometry, orientation, position and height, surrounding buildings, upstream terrain and the local wind climate. Over the years, RWDI has conducted thousands of wind-tunnel model studies regarding pedestrian wind conditions around buildings, yielding a broad knowledge base. This knowledge has been incorporated into RWDI's proprietary software that allows, in many situations, for a qualitative, screening-level numerical estimation of pedestrian wind conditions without wind tunnel testing.

Short buildings or buildings of a similar height do not redirect winds significantly to cause adverse wind conditions at pedestrian areas (Image 6a). Buildings taller than the immediate surrounding may intercept winds and deflect them down to the grade level (Downwashing, Image 6b). The downwashing flow may accelerate around building corners (Corner Acceleration, 6c), along gaps between buildings (Channelling Effect, 6d) and through passages underneath buildings (Passage Flow, 6e), resulting in increased wind activity at grade. If these building / wind combinations occur for the prevailing winds, there is a greater potential for increased wind activity and uncomfortable conditions.

Given the local wind climate and the low height of the proposed development, it is our opinion that the wind safety criterion will be met at all areas on the school campus. There is no area where wind conditions are predicted to be uncomfortable either. However, from time to time, wind speeds around exposed building corners and between the proposed buildings may become higher than desired for passive activities such as sitting and standing.

Detailed discussions on the potential wind comfort conditions at key outdoor areas are provided in the following section.

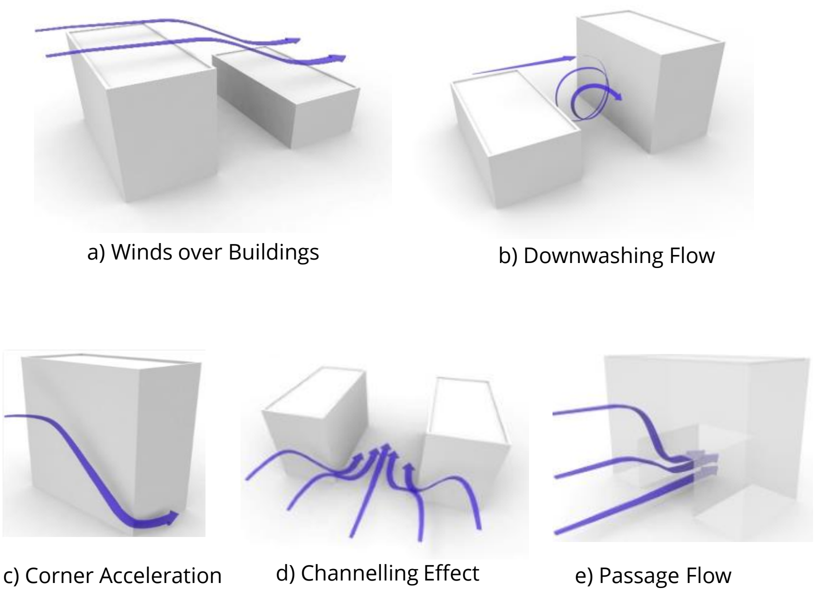



**Image 6: General Wind Flow Patterns**

## 5.2 Predicted Wind Conditions

There are several positive features for wind control on and around the project site. For instance,

- The proposed buildings are three storeys or lower;
- They are surrounded by taller buildings to the south, by trees to the west and by typical dense low-rise suburban residential buildings in other directions.
- The existing and proposed landscaping on and around the site will provide additional wind protection.

### Outdoor Areas at Grade

Image 7 shows key outdoor areas labeled on a ground floor plan. As discussed previously, winds from the southeast through west directions are sheltered by the existing buildings and trees, but the prevailing northeast and northwest winds may accelerate through the central entry corridor (A in Image 7), and along the west and east façades of the main building (B and C, respectively). The resultant wind conditions are expected to be comfortable for strolling and walking, but unsuitable for more passive activities such as sitting and standing.

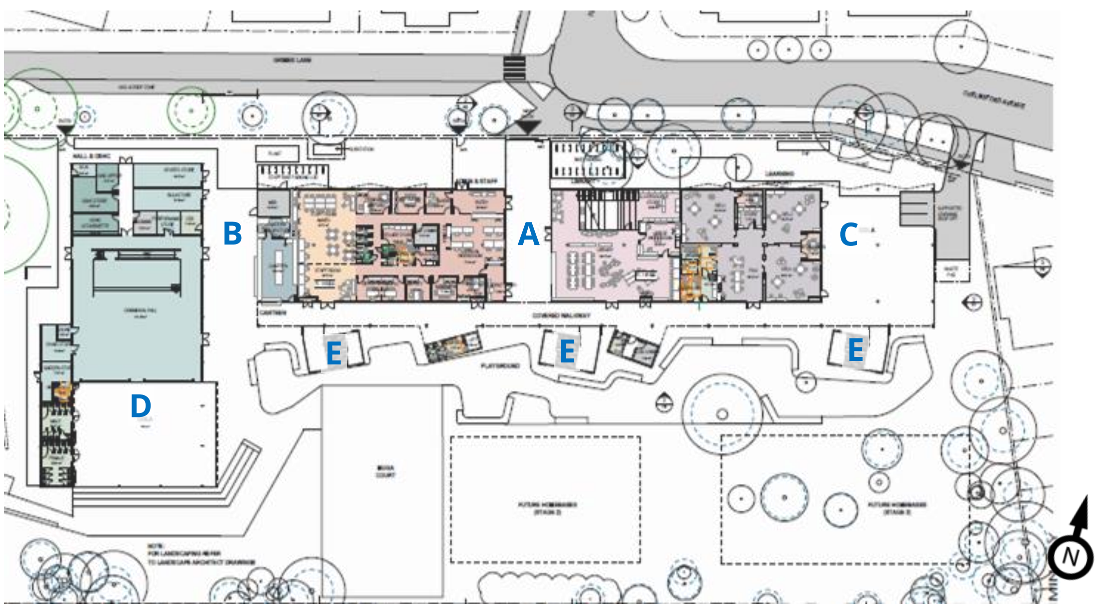



**Image 7: Key Outdoor Areas at Grade**

# 5. PEDESTRIAN WIND CONDITIONS

### Outdoor Areas at Grade (continued)

All entrances are designed with doors that open outward. Doors that open outward may catch the winds that accelerate along building façades, resulting in potential issues with user comfort and door operation, particularly in locations where winds will be channeled (locations A and B in Image 7).

If desired, improved wind comfort and door operability can be achieved by recessing these doors into the building façades, if feasible, and/or installing wind screens or planters on both sides of the doorways – see Image 8 for examples.

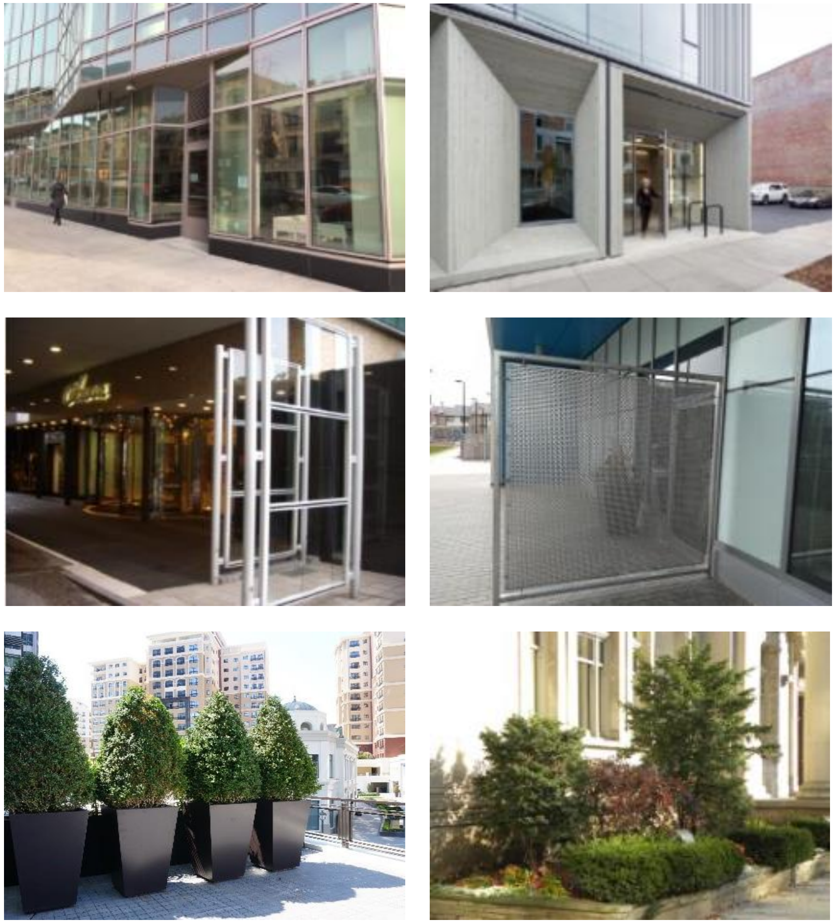


**Image 8: Wind Control Measures for Entrance Doors Open Outward**

# 5. PEDESTRIAN WIND CONDITIONS

**Outdoor Areas at Grade (continued)**

On the east side of the building (Location C), a covered outdoor learning area (COLA) is planned. Both the northwest and northeast winds may affect this area, especially the northerly portion, resulting in higher-than-desired wind speeds for students. Windbreaks such as fences, screens, glass panels and planters are recommended for the north perimeter, including the northeast corner of the COLA. They should be taller than 2m and with some small porosity for effective wind control – see Image 9 for examples.

There is another COLA at grade, located on the south side of the communal hall (Location D in Image 7). Relatively calm wind conditions are expected due to sheltering offered by the proposed building to the north and the existing buildings to the south. The existing and proposed landscaping to the west and east will further improve the wind conditions.

Staircases (Locations E) are located on the south side of the building and protected by the proposed and existing buildings, plus mesh screens, from the winds. As a result, suitable wind conditions are predicted for these areas. However, depending upon the details of these mesh screens, issues associated with wind-induced noise may need to be reviewed.

In addition, the proposed car parking and playground to the west (Image 1) are surrounded by trees and buildings, and suitable wind conditions are predicted throughout the year. Two future classroom buildings are two storeys, lower than the adjacent buildings to the north and south. They will not cause any significant effect on the wind conditions on the campus.

**Surrounding Neighbourhood**

The low-built form of the proposed school is anticipated to generally shelter neighbouring residences from the prevailing winds. Overall, a minimal change to the current wind environment is anticipated. Future staging as shown in Image 3 is likewise not anticipated to impact conditions.

**Image 9: Examples of Windbreaks for COLA**

# 5. PEDESTRIAN WIND CONDITIONS

### Outdoor Areas above Grade

Image 10 shows floor plans for Levels 1 and 2. Similar to the above discussion, calm wind speeds are expected for the staircases (Locations E) at the above-ground levels.

A small COLA at Level 1 is located at the centre of the floor and enclosed by classrooms from three sides (Location F). Suitable wind conditions are therefore expected in this area throughout the year.

A large COLA at Level 1 is located above the central passage (Location G in Image 10), where wind speeds may be high for students from time to time. Tall windbreaks are recommended on the north side – see Image 9 for reference. If desired, additional wind protection can be provided by balustrades along the east side of the space; however, it is recommended that they be taller than a standing or sitting student, depending upon the planned activities in the class.

The previous comments regarding outward-opening doors (location marked by a blue arrow in Image 10) apply to above grade areas as well, however as screens or planters are not practical on the walkway, recessing the doorway or having the doors open inward would be preferred.


**Image 10: Floor Plans for Levels 1 and 2**

# 6. SUMMARY

Wind conditions on and around the proposed New Public School in Epping, NSW are discussed in this report. Our qualitative assessment was based on the local wind climate, the current design of the proposed development, existing surrounding buildings and our experience with wind tunnel testing of similar buildings.

The proposed buildings on the school campus are three storeys or lower. They are surrounded by taller buildings to the south, trees to the west and dense residential buildings in other directions. As a result, the wind safety criterion will be met at all outdoor locations on and around the campus. Suitable wind comfort conditions are also expected in outdoor areas such as walkways, staircases, car parking, playground and some COLAs.

Entrances where doors open outward may be subject to winds along building façades. If desired, improved wind comfort and door operability can be achieved by recessing these doors into the building façades, if feasible, and/or installing wind screens or planters on both sides of the doorways

Two exposed COLAs, one on the east side of the main building and the other at the centre of Level 1, are predicted to have wind speeds higher than desired for passive activities such as sitting or standing. If desired, lower wind speeds can be achieved by windbreaks, primarily on the north side of these spaces.

The low-built form of the proposed school is anticipated to generally shelter neighbouring residences from the prevailing winds.  Overall, a minimal change to the current wind environment is anticipated for both proposed and future staging configurations.

# 7. APPLICABILITY OF RESULTS

The assessment presented in this report for the proposed New Public School in Epping, NSW was based on the architectural design drawings and documents received by RWDI on April 14, 2021.

In the event of any significant changes to the design, construction or operation of the building or addition of surroundings in the future, RWDI could provide an assessment of their impact on the pedestrian wind conditions discussed in this report. It is the responsibility of others to contact RWDI to initiate this process.